Industrial Recycling in El Salvador

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Abstract

Globally an increased awareness for the preservation of the planet is perceived. Different strategies are being held by countries in order to minimize problems such as pollution, access to vital resources, a responsible disposal of waste, and others. Part of this problem are the industries that generate pollution through the resources they exploit or directly through their waste. This study presents six different companies, conveniently selected in El Salvador, that include green initiatives into their business core in order to minimize the negative impact of their processes over the environment. They are well-known companies and stand out for the quality of their work. The research is qualitative, the methodology used to perform it was descriptive. The information collected from different sources guided the analysis of the theme in order to provide the guideline to the creation of the industrial recycling cluster in El Salvador. In order to propose the cluster, the researchers used Porter´s Diamond Model and the Five Forces Analysis. The results show that there are several advantages for the establishment of a cluster, such as, technology, training, internal resources within the companies, and others. On the other hand, the cluster will need more support from the government, communities and the citizens since most of the problems are due to the lack of regulations and the recycling culture in the population.

Key words: strategies, human capital, bibliometric analysis, organizations.

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1. Introduction

This research was carried out by a multidisciplinary team following the Microeconomics of Competitiveness course (MOC) developed by Professor Michael Porter and the Institute of Strategy and Competitiveness of Harvard, taught by Universidad Católica de El Salvador, UNICAES.

Professor Porter provided the definition of cluster as "a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities", it is shown On Competition, that a cluster can be a country, city, state or a network of neighbor countries (Porter, 2008).

According to Professor Porter, a cluster needs to take advantage of the resources; in El Salvador, natural resources can decrease if industrialization practices are not regulated. That is why it is crucial to take company's waste as a resource and work with the government and educate communities to identify these opportunities for developing a cluster and compete worldwide.

For years, the belief that a determined location could increase competitiveness has already failed; it is important to understand how to compete. That was the main purpose of this research, to analyze an industrial recycling cluster where factories and companies share their best practices, reduce waste which can also transform into a new business model.

The analysis was performed using Porter's Diamond Model and the Five Forces Analysis (Porter, 2008) as well a detailed research focused on six companies that are working with recycling initiatives in El Salvador.

Conceptualization

In order to address climate change and its effects, there are global trends proposed by various organizations that arise or are inspired by the sustainable development goals proposed by the United Nations Organization. The 17 goals set by the United Nations in order to accomplish the 2030 agenda include: end of poverty, improve health and education, reduce inequalities and economy growth (Sustainable Development Goals Knowledge Platform, n.d.)

Recycling and to implement a circular economy model, reaches seven of them: no poverty, clean water and sanitation, affordable and clean energy, decent work and economic growth, sustainable cities and communities, responsible consumption and production which will take actions to fight climate change and its consequences.

In relation to the issue of industrial recycling, the trends of green jobs, circular economy and a second life for various products are presented, focusing mainly on those that are raw material to generate more energy. Each one of them is described below.

Recycling trends

Green Jobs and Green Initiative

A green job is considered any type of job that produces a service related to environmental conservation and management that uses processes more sustainable within any industry, but also has to include decent work conditions. In addition, green jobs have to help decrease environmental crisis (ILO, International Labor Organization, 2017).
Based on the Green Initiative (2016), starting from the fact that a healthy planet is directly linked with offering decent sustainable jobs

and vice versa, the green initiative is created by ILO. The most important areas are:

1. Advanced research and understanding of the challenges and opportunities for the world of work arising from a green transition.
2. Force policy responses from the world of work in all sectors to ensure decent work and social justice for all.

Build strategic partnerships at national, regional and international levels.

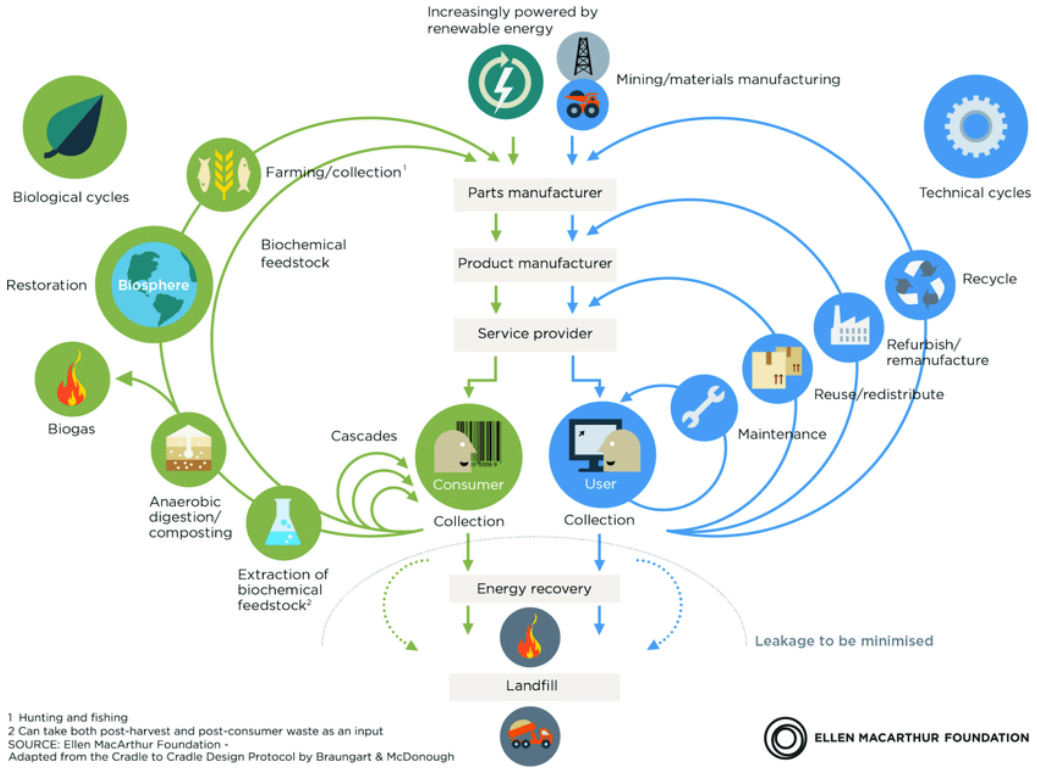
Circular Economy

The International Institute for Sustainable Development (IISD) defines it as: "A model in which we design, produce and use products, that feeds the reduction of waste and facilitates the regeneration of natural systems" (IISD, International Institute for Sustainable Development, 2019). To reuse every resource of a company determines a big impact in its economy, it includes recycling but also reusing and recovering, and implies to set strategies to innovate their business model.

In 2015, the European Commission adopted an ambitious Circular Economy Action Plan, which includes measures that will help to stimulate Europe's transition towards a circular economy, boost global competitiveness, foster sustainable economic

Figure 1

Circular economy diagram



Note. The diagram shows how waste can be transformed by companies (Piscicelli & Ludden, 2016, p. 24).

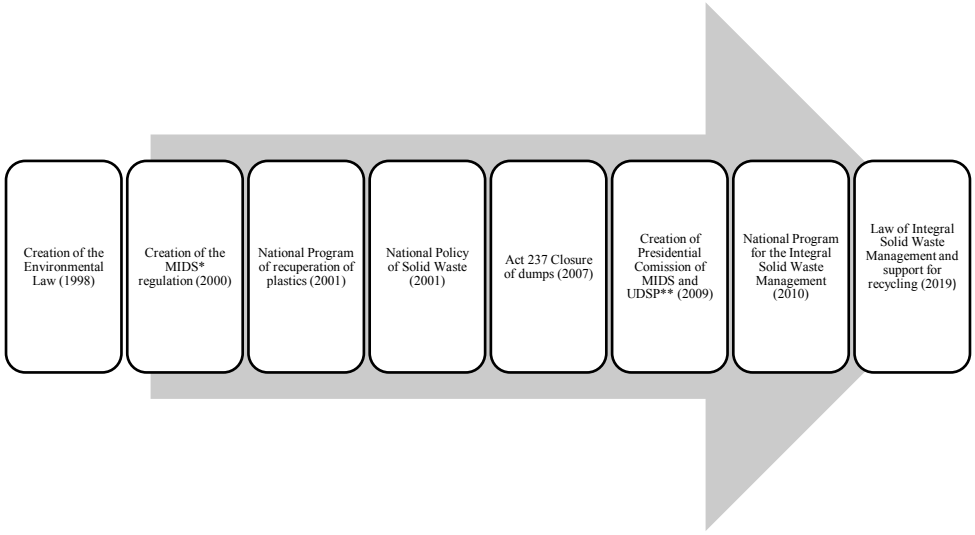
growth and generate new jobs, all these actions have their own platform of stakeholders who are committed to incorporate this plan into their industries (European Comission, 2020).

El Salvador context

In 1997, the executive branch of the Salvadoran government created the Ministry of Environement and Natural Resources (Ministerio del Medio Ambiente y Recursos Naturales, MARN). This ministry is responsible for formulating, planning and executing government policies regarding the environment and natural resources. In 1998, in accordance to the legislative decree number 233 the law of environment that aims to develop the provisions of the constitution of the Republic was created; this law refers to the protection, conservation and recovery

Figure 2

Timeline of the actions regarding management of solid waste in El Salvador



Note. *MIDS, Integral Solid Waste Management (Manejo Integral de Desechos Sólidos), prepared by the authors.

of the environment, and the sustainable use of natural resources that allows to improve the quality of life of present and future generations (Ministerio de Medio Ambiente y Recursos Naturales MARN, 2020).

Structure of Recycling Industry in El Salvador

Some companies in El Salvador are trying new initiatives regarding recycling in order to reduce the impact to the environment. Their purpose is to recycle, recover and reprocess waste materials. The basic phases in recycling are the collection of materials, processing into new products or materials, and the purchase of those products, which may then be recycled.

There are two types of recycling operations based on the editors of the Britanica Encyclopedia (2019):

Internal recycling: Internal recycling is the reuse in a manufacturing process of materials that are a waste product of that process.

Internal recycling is common in the metals industry; for example, the manufacture of copper tubing results in a certain amount of waste in the form of tube ends and trimmings; this material is remelted and recast. Another form of internal recycling is seen in the distilling industry, in which, after the distillation, spent grain mash is dried and processed into an edible foodstuff for cattle.

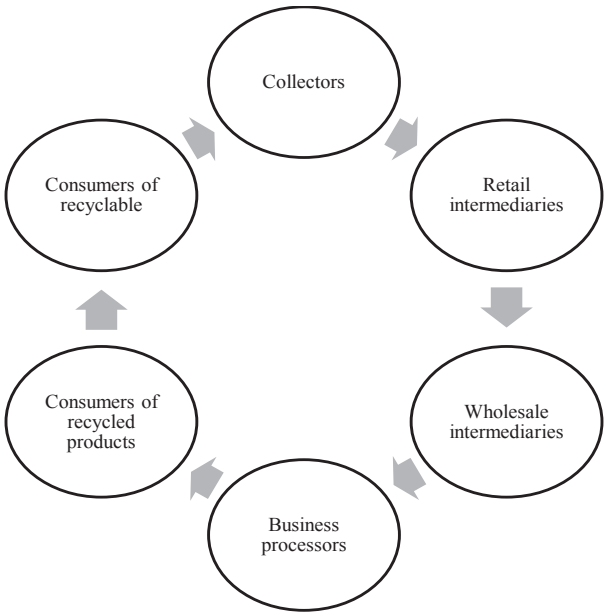
External recycling: External recycling is the recovery of materials from a product that has been worn out or rendered obsolete.

An example of external recycling is the collection of old newspapers and magazines for pulping and their manufacture into new paper products. Aluminum cans and glass bottles are other examples of everyday objects that are externally recycled on a wide scale.

These materials can be collected by any of three main methods: buy-back centers, which purchases waste materials that have been sorted and brought in by consumers; drop-off centers, where consumers can deposit waste materials, but are not paid for them; and curbside collection, in which homes and businesses sort their waste materials and deposit them by the curb for collection by a central agency. In the external recycling cycle there exists different actors, these are pointed out in the figure number four.

Figure 3

Timeline of the actions regarding management of solid waste in El Salvador



Note. The figure shows how the actors of the recycling are organized, prepared by the author based on ((MARN), 2006)[4]

4. MARN, Ministry of the Environment and Natural Resources (Ministerio de Medio Ambiente y Recursos Naturales)

If reusing is impossible, there are other options, such as the co-processing of waste materials. In El Salvador companies have access to work with Geocycle, a leading provider of industrial, agricultural and municipal waste management services worldwide. They use the co-process of waste materials, "It refers to the simultaneous recycling of mineral materials and recovery of energy within one single industrial process: cement manufacturing" (Geocycle, 2020).

Companies in El Salvador with recycling initiatives

There are several companies in El Salvador that have very good initiatives regarding industrial recycling. A brief description of different projects in El Salvador is presented next.

Holcim (2030 Plan)

It focuses on improving the sustainability of all their operations. They are committed to work in partnerships to make the entire construction value chain more innovative and more mindful of the use of resources and the impact on nature. This plan includes: climate, circular economy, water and nature, people and communities (Holcim, 2020).

Iberplastic (Clean Planet)

It is a company that makes brooms, shovels and brushes from recycled plastic materials such as PET bottles and other containers. It has more than 20 years of experience and exports its products to the United States, the Caribbean and Central America (Iberplastic, n.d.). It also has implemented its own certification called "Certification of Excellence Clean Planet", and two important hotels have it, Courtyard and Fairfield, (Diario 1, 2019).

Parque Industrial Verde (Green industrial Park) (Recicla El Salvador)

"Industrial Complex whose main objective is to become an ally of those companies in which their main activity is the welfare of the environment" (Parque Industrial Verde, 2017). There are two companies included in Parque Industrial Verde, one of them is Zartex, which recollects obsolete electronic devices to reuse them. The Ministry of Environment has authorized them for the disassembly of electronic equipment; it is the first and only one in El Salvador. The other company is INSEMA; they recycle plastic (PET, Polycarbonate, ABS, HDPE , among others), non-ferrous (beverage cans, window profiles, pots and pans, radiators, etc.) and ferrous material (industrial structures, screws).

Kimberly Clark (Zero Waste, 2022 goals)

This program includes all waste materials generated at both manufacturing and outlets (see figure 4). The main points are: 1) Use materials efficiently in product and packaging design and manufacturing. 2) Develop more circular business models with the mprovement in relation to materials and technologies and also innovations (Kimberly-Clark, 2017).

Termoencogibles (Recicla 503)

It is an initiative that makes closer the recycling process with the final users. They work with strategic partners with whom they share awareness talks regarding the recycling of the following wastes: bags, packing,

straws and plastic caps. The strategic partners locate their collecting points for their direct users. To the date, they have visited four major cities in El Salvador: La Libertad, San Salvador, Santa Ana and San Miguel (Termoencogibles, n.d.).

They believe in leaving the environment in better conditions. They also believe in doing the right thing for the planet and in the importance of a circular economy. They think "Recycling is sustainable" and a crucial part of the solution. For them, recycling is the industry of the future providing Salvadoran with job sources. They want to change the way how things have been doing, they want to work with new renewal raw materials (Termoencogibles, 2019).

San Julian (Circular Economy)

Agroindustria San Julian S.A. de C.V. or Agrosania S.A. de C.V. is a family agro-industrial Company founded on January 1985. Their primary purpose is the maximum use of its resources through a horizontal integration to provide products and services of superior quality that meet the needs of their customers, minimizing in turn the impact on the environment through the use of the generated by-products of their productive processes and economic activities to live in harmony with nature (Agrosania S.A. de C.V., n.d.).

Table 1

Non-hazardous manufacturing waste at Kimberly Clark until 2017

NON-HAZARDOUS MANUFACTURING WASTE (% OF TOTAL NON-HAZARDOUS WASTE)[1]	2010	2011	2012	2013	2014	2015	2016[2]	2017
Landfilled	19.1%	24.5%	22.0%	19.2%	16.2%	7.6%	5.6%	**4.7%**
Recycled	18.5%	17.6%	20.2%	19.6%	18.3%	20.3%	20.6%	**21.7%**
Alternative daily cover, mine reclamation and liquid solidification	24.1%	22.5%	25.9%	29.2%	34.1%	40.0%	52.0%	**51.5%**
Converted to energy	20.3%	20.4%	12.4%	12.2%	12.2%	12.7%	14.4%	**14.1%**
Reused	12.1%	13.3%	17.8%	18.1%	17.2%	16.7%	5.0%	**5.5%**
Composted	5.0%	1.1%	0.9%	0.9%	1.2%	2.0%	1.6%	**1.8%**
Incineration without heat recovery	0.8%	0.5%	0.9%	0.8%	0.7%	0.7%	0.8%	**0.5%**
Other[3]	N/A	N/A	N/A	N/A	N/A	N/A	0.2%	**0.1%**
Total non-hazardous waste (million MT)	**1.37**	**1.29**	**1.33**	**1.28**	**1.25**	**1.15**	1.23	**1.21**

(1) At Kimberly-Clark, all waste data is collected by mass except a portion of liquid waste which is collected by volume in liters with a conversion factor of 1 liter = 1 kilogram.
(2) In 2016, our manufacturing waste program was expanded referencing the UL Environment Zero Waste to Landfill standard to include all wastes and recyclable materials generated at both manufacturing and non-manufacturing facilities and the disposition of those materials. Our non-hazardous manufacturing waste data was updated per our annual review process.
(3) Other includes miscellaneous, alternative disposal methods and was separated from Reuse in 2016.

Note. Taken from (Kimberly-Clark, 2017).

2. Methodology

The research is qualitative, the methodology used to perform it was descriptive. The analysis seeks to provide an overview of the implementation of industrial recycling as a fundamental practice for all companies.

The information collected from different sources guided the analysis of the theme in order to provide a guideline to the creation of the industrial recycling cluster in El Salvador. To do so, the concepts, approaches of industrial recycling, circular economy, and initiatives of companies that apply different methods of industrial recycling were reviewed. After collecting the data, Michael Porter's Diamond Model and the Analysis of the Five Forces were used. This analysis consists on evaluating the competitiveness of a country, industry or company.

The sample of the research was selected by convenience. Six different companies that apply industrial recycling processes as a way to reduce their costs were chosen. The companies are: Termoencogibles, Iberplastic, Parque industrial Verde, Holcim, Kimberly Clark and San Julián.

3. Results

The results show the analysis of the advantages, chances, threats and risks of the creation of the recycling cluster in El Salvador. In order to perform it, the authors used the Diamond Model and the Analysis of the Five Forces proposed by Porter (2008).

Diamond Model

Factor conditions

Despite there are several advantages that make El Salvador a potential player in the recycling industry, such as the geographical location, the attractiveness for investors to initiate operations, etc., there are also some disadvantages that play a crucial role; for instance, the lack of security, the poor culture of recycling and the lack of support to create a bigger cluster integrating the government, the industry and communities.

Demand conditions

Another advantage is that the main actors of the recycling market are organized. Through the years, they have supplied national and international companies with recyclable materials.

On the other hand, due to the lack of regulation of the recycling market, there is a lack of established prices, and therefore, it is unattractive to dedicate to this area and the people who do it, do so because they have not found another source of employment, they do not have health insurance, and will not have pension for their retirement, and much less have an equipment for waste management (Hernández, 2019).

Context for the cluster

The context for the cluster offers several advantages that must be taken into account. El Salvador is a niche of opportunities for this cluster. There already exist different companies that have brilliant initiatives regarding recycling that could be expanded. Moreover, there is a law that regulates the processes regarding recycling. And it is a win-win strategy since the company gets benefited, but also the environment and communities. Although there are some aspects that need to be revised, such as the promotion of recycling practices and its benefits, and the inclusion of the government, industry and communities' triad.

Related and support industries

ASIPLASTIC (Salvadoran Association of the Plastic Industry) is an association made up for more than 80 companies of the plastic industry. The association is looking forward to the continuous improvement of processes and the strengthening of the competitive position of companies in the Plastic Sector. They also implement educational projects in communities and schools (ASIPLASTIC El Salvador, n.d.).

The government of El Salvador has already a plan to promote and develop a model of a circular economy with CTCN (Climate Technology Center and Network) integrating public and private stakeholders. This includes the universities; for instance, Universidad Gerardo Barrios will cooperate with the Foundation of Circular Economy of Spain, to develop the Observatory of Circular Economy of El Salvador (Ecoticias).

Nevertheless, even with the efforts of the Government, there are no tax incentives for companies that incorporate recycling processes; these include the purchase of machines but also import and export processes. In order to, the companies responsible for generating waste should pay an extra tax.

Chance

The growing concern about the deplorable condition of the environment raises awareness at the international level. Companies in El Salvador should take advantage of this; first by creating a better image implementing good recycling practices and second by reducing costs through recycling, which becomes an advantage for any company in financial matters.

Government

The government of El Salvador has made several advances in the area of recycling, since there exist institutions that regulate the practices in industries. Although they still need to work on promoting laws and good practices. The Institutions who care for the environment must work as a team with companies and communities (See figure 4).

Five Forces Analysis

Threats of new entrants

In terms of circular economy, each company should have their own recycling system, if specialized companies control one or every steps of industrial recycling, companies will lose the chance to take advantage of it and reduce waste of materials and money. On the other hand, if the government will be a mainstream player there should not be bureaucracy to access the services of industrial recycling.

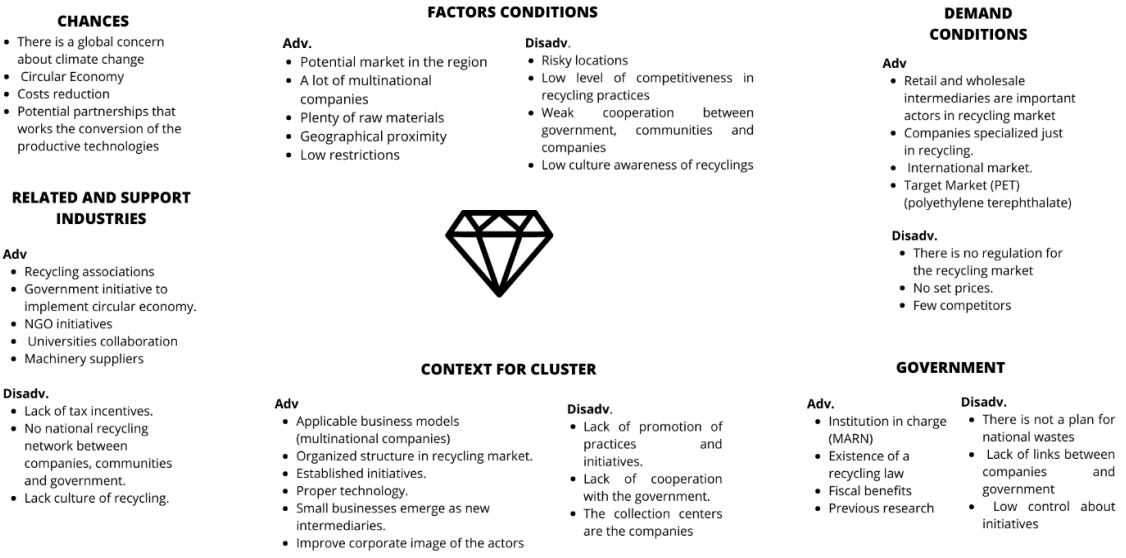
According to a study of the Ministry of environment and Natural Resources ((MARN), 2006), some recycled materials are exported, but also there is a quantity of recycled materials that are imported because the national market is not able to treat them. If this continues El Salvador will lose a great opportunity to reduce waste which also is a threat to the environment.

Powers of buyers

The main purpose of this is for companies to benefit from their raw and leftover materials and use them in another product or process, so they can reduce waste and save money. The material is already in the enterprise; they just need to treat it to close the cycle.

Figure 4

Diamond Model



Note. Prepared by the authors.

In contrast of the previous statement, there is a huge benefit of exporting recycled resources, but just if the national market is already stocked and has a good logistic collection. The international market includes the Central and North American countries, Asia and others.

Rivalry among competitors

There are a few companies whose field is only recycling in a specific industry; with the lack of circular economy education, it is easier to hire these companies through outsourcing. Regarding the same topic, specialized companies have the latest technology and these will make them a strong competitor.

Threats of substitute products

On the other hand, biodegradable plastics are made from plants, which is a good alternative to reduce impact to the environment. These products are made from alternative materials, in some cases organics, to replace or reduce the use of plastic, Song, Murphy, Narayan and Davies (2009) set that "Depending on their origins, BDPs (Biodegradable Plastics) may be classified as being either bio-based or petrochemical-based. The former is mostly biodegradable by nature and produced from natural origins (plants, animals or microorganisms) such as polysaccharides (e.g. starch, cellulose, lignin and chitin), proteins (e.g. gelatin, casein, wheat gluten, silk and wool) and lipids (e.g. plant oils and animal fats)". By using only these organic elements, the need for plastic recycling will not be necessary, even though some of them are not 100% safe, some of them decompose and produce methane gas (Woodford, 2020).

There are a lot of products that citizens could recycle by themselves, but as they do not

know efficient ways of doing so, these could be potential loss for companies if they do not have access to these waste.

Power of suppliers

The lack of recycling machine suppliers in El Salvador or Central America, increases the prices for companies that want to implement these practices. Prices can go from $2,000 up to $300,000 or above, depending on the raw material to be transformed, the condition (dirty, clean, oil contained, etc.), and its weight.

If there is a strong agreement with small suppliers, the effort involved in obtaining the recycled materials will be reduced.

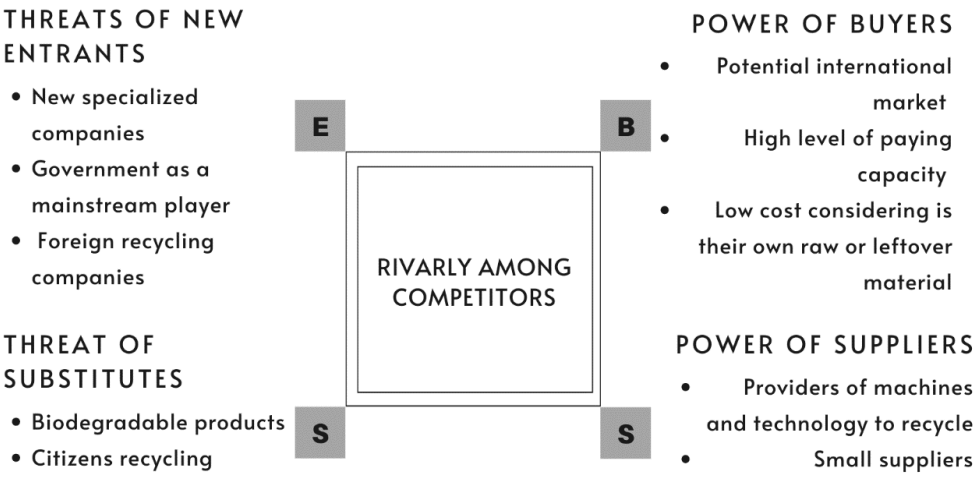
4. Discussion

The recycling industry in El Salvador is rapidly growing. Between January 2011 and November 2012, the country exported more than seventy nine millions in recycled products (El Diario de Hoy, 2013). Moreover, the market is organized and in constant innovation. The industry is well established and companies that are already working with some initiatives can lead the cluster.

In addition, the demand for recycled products is increasing since it is an opportunity for business and at the same time, a way to preserve the environment. For companies, it is also a way to close the production cycle, improve their economy and corporate image. That is why the following cluster map is suggested by the researchers.

Figure 5

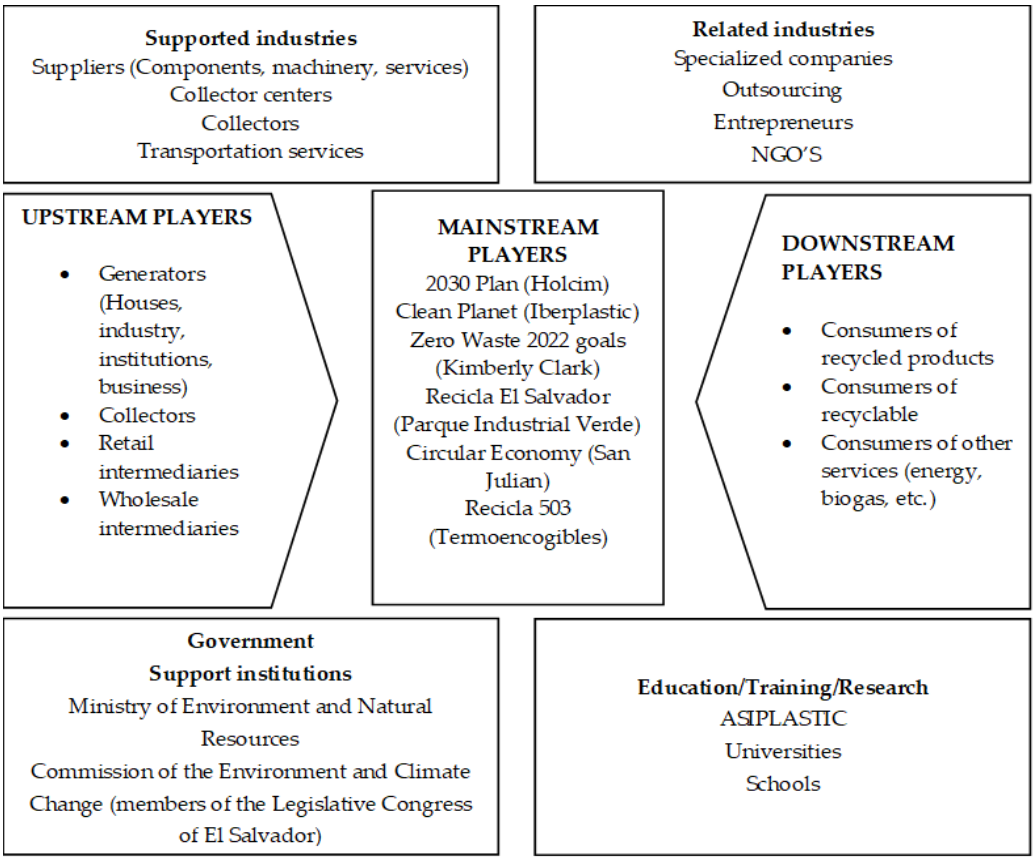
Five forces analysis



Note. Prepared by the authors.

Figure 6

Five forces analysis



Note. Prepared by the authors.

The recycling culture must be immersed in the company's core. By doing so, companies can increase competitiveness and take advantage of the potential of recycling for their own benefit. In addition, establishing relationships with neighbor communities and non-profit organizations is a win-win strategy, because some companies may want to be part of the industrial recycling cluster, but investment in technology is a limitation. Incorporating the circular economy in the companies´ processes implies investment of resources such as time and money; therefore, few companies commit to making changes in their way of doing business. This is why companies can form strategic alliances with the private and public sectors to apply for financial aid that will allow them to invest in technology and professional training. Another option is to look for foreign investment from organizations that commonly seek to support the country's economic development in these areas.

Regarding human talent, all recycling processes require trained talent with national and international certifications, knowledge of laws, and trends. And, according to

the results of the statistical information of higher education institutions in 2018 from the MINEDUCYT, there are just 101 professionals in the field of agriculture and environment with a Master's degree (Ministerio de Educación, Ciencia y Tecnología MINEDUCYT, 2020).

Unfortunately, recycling is not a focus of the Salvadoran government. Even though MARN proposed a plan to clean rivers of garbage and solid waste with "riobardas" and the recovering of forest, recycling is not mentioned or included in the plan. This is alarming, since, not attending the contamination industry and companies create will cause irreversible damages to nature (Ministerio de Medio Ambiente y Recursos Naturales MARN, 2020). It is necessary to increase awareness of the recycling law for companies, town halls and communities.

Some other aspects that represent challenges for the industry, based on the report from MARN (Ministerio de Medio Ambiente y Recursos Naturales MARN, 2020) are: include in the Strategic environmental assessment a recycling policy; increase and promote tax incentives for recycling industries and factories that include sustainable practices; increase and promote tax un-incentives for companies producing waste and threats to the environment.

Regardless all the efforts, companies, the government and other institutions do in relation to recycling, if people are not part of the change the initiatives can fail. In general, Salvadorans do not have the recycling culture, and this is a big issue when trying to implement recycling programs within the communities.

And last but not less important, due to the global pandemic of Covid-19, the enterprises and communities worldwide have been affected. In El Salvador some factories and enterprises had to close and stop their production due to national quarantine. According to a study run by Universidad Centroamericana José Simeón Cañas (UCA) to 300 businesses show that the 88.66% of them have experimented an adverse or negative impact.

The 14% closed their businesses. Nowadays every company can adapt to clauses of new normality, some have investe and bought personal protective equipment to guarantee their employee's and client's safety, instead of investing in recycling techniques and technology. In addition, if these single use facemasks, gloves, gown and others are not biohazard treated, they are potential contaminators of the environment.

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